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(21) International Application Number: PCT/US96/01777 (22) International Filing Date: 1 February 1996 (01.02.96) (30) Priority Data: 112581 8 February 1995 (08.02.95) IL (71) Applicant (for TJ only): FRIEDMAN, Mark, M. [US/IL]; 1 Alharizi, 34306 Raanana (IL). (71)(72) Applicants and Inventors: MOREH, Ronen [IL/IL]; 6 George Eliot Street, 65235 Tel Aviv (IL). YEMINI, Ofer [IL/IL]; 8 Avivim, 58267 Holon (IL). (74) Common Representative: FRIEDMAN, Mark, M.; c/o Robert Sheinhein, 2940 Birchtree Lane, Silver Spring, MD 20906 (US).		(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AZ, BY, KG, KZ, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: POP RIVET (57) Abstract <p>A pop rivet for connecting two or more bodies together. The pop rivet includes a rotatable inner rod (12) having a drilling head (18) at its forward end with a portion of the inner rod being externally reverse threaded. The pop rivet further includes a sleeve (10) which surrounds a portion of the inner rod. The sleeve has a body and an enlarged head (14) at its posterior end. A portion of the sleeve is internally reverse threaded so as to engage the externally reverse threaded inner rod.</p>		

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POP RIVET

FIELD AND BACKGROUND OF THE INVENTION

The present invention relates to rivets and, more particularly, to the variety of rivets known as pop rivets.

5 Rivets are widely used to quickly and permanently connect two or more members, typically two metal plates. One popular rivet is known in the industry by the designation a pop rivet.

One design of a conventional pop rivet is shown in Figure 1. The pop rivet includes a hollow cylindrical outer sleeve 10' which surrounds
10 a portion of an inner rod 12' which fits inside sleeve 10'. Inner rod 12' is longer than sleeve 10' so that one of its ends extends well beyond the end of sleeve 10'. Sleeve 10' features an enlarged head area 14' at one of its ends which has a diameter which is significantly larger than that of the body of sleeve 10'. The other ends of sleeve 10' and rod 12' are
15 connected to each other in some suitable fashion, e.g., the far end of inner tube 12' is slightly enlarged so that its effective diameter is somewhat larger than the inner diameter of sleeve 10', so as to act as a single integral piece, until a certain critical phase of the installation as described next.

20 The function of a pop rivet is to connect two, or more, pieces together. For ease of presentation, the description herein will relate to the connection of two metal plates, it being understood that more than two

items of various materials may be connected in the same way using a pop rivet.

Installing a conventional pop rivet is a three step process. First, a conventional drill is used to drill a hole through the two metal plates to be
5 connected. The diameter of the drilled hole is equal to, or slightly larger than, the outer diameter of the body of sleeve 10'.

Once the hole has been drilled, the user takes a pop rivet, such as the one shown in Figure 1, and inserts sleeve 10' through the hole so that head area 14' rests against the front surface of the first metal plate 16' and
10 the end of sleeve 10' extends beyond the second plate 18' to be connected (see Figure 1).

Once the pop rivet has been fully inserted, the user takes a special riveting tool (not shown) which is designed to pull on inner rod 12' in the direction away from metal plates 16' and 18' while simultaneously
15 pressing head area 14' in the opposite direction, i.e., toward metal plate 16'.

The pulling of inner rod 12' brings about the deformation of the far end of sleeve 10' so that the effective diameter of the far end of sleeve 10' becomes larger than that of the hole through metal plate 18'. Continued
20 pulling on inner rod 12' places the enlarged portion of sleeve 10' up against the back surface of metal plate 18' so that no further motion of sleeve 10' is possible. At this point, continued pulling of inner rod 12'

causes inner rod 12' to break off near its far end, leaving sleeve 10' permanently in place to firmly connect metal plates 16' and 18'. The broken off inner rod 12' is simply discarded, its function having been performed.

5 A disadvantage of conventional pop rivets, such as the one described above, is that their installation is relatively complex and time consuming. Thus, to install a conventional pop rivet a hole must first be drilled through the plates to be connected. The drill bit is then withdrawn and the drill is set aside. The plates need to be immobilized relative to
10 each other so that the hole through both plates remains aligned. The conventional pop rivet is then inserted into the hole previously drilled in the plates and a special rivet tool is used to effect the permanent installation of the rivet. The rivet tool is typically pneumatically operated, which requires ready access to a source of compressed air, which may not
15 always be conveniently available. Alternatively, the pneumatic rivet tool can be powered through the repeated stroking produced manually by the user, which requires physical force and could cause fatigue and aches and takes considerable time.

There is thus a widely recognized need for, and it would be highly
20 advantageous to have, a pop rivet which could be installed in a fraction of the time required to install a conventional pop rivet and without requiring a source of compressed air.

A pop rivet according to the present invention can be installed using a conventional drill using a special bit which is designed to rotate the inner rod of the pop rivet. Thus, the installation of a pop rivet according to the present invention requires only a single action which resembles drilling.

5 Use of a pop rivet according to the present invention thus obviates the need to pre-drill a hole through the objects to be connected and the subsequent removal of the drill bit and installation of the pop rivet, which requires a special rivet tool which is normally pneumatically driven.

SUMMARY OF THE INVENTION

10 According to the present invention there is provided a pop rivet for connecting two or more bodies together, comprising: (a) an inner rod having a drilling head of an effective diameter at its anterior end, at least a portion of the inner rod being externally reverse threaded, the inner rod including means for facilitating rotation of the inner rod; and (b) a sleeve
15 surrounding at least a portion of the inner rod, the sleeve having a body and an enlarged head at its posterior end, at least a portion of the sleeve being internally reverse threaded so as to engage the externally reverse threaded inner rod.

According to further features in preferred embodiments of the
20 invention described below, a portion of the body of the sleeve near the

enlarged head has a diameter which increases beyond the effective diameter of the inner rod drilling head toward the head.

According to still further features in the described preferred embodiments, the inner rod includes one or more radial protrusions or a
5 polygonal shape at its posterior end to facilitate rotation of the inner rod.

The present invention successfully addresses the shortcomings of the presently known configurations by providing a pop rivet which can be installed very quickly using a single tool which is not necessarily pneumatically driven.

10 BRIEF DESCRIPTION OF THE DRAWINGS

The invention is herein described, by way of example only, with reference to the accompanying drawings, wherein:

FIG. 1 is a side cross-sectional view of a conventional pop rivet;

FIG. 2 is a side cross-sectional view of one embodiment of a pop
15 rivet according to the present invention;

FIG. 3 is an end view of the pop rivet of Figure 1;

FIG. 4 is a side cross-sectional view of the sleeve portion of a typical rivet according to the present invention;

FIG. 5a and 5b show side and end views of a tool which might be
20 used to install a pop rivet such as that shown in Figure 1 and 2; ;

FIG. 6 is a side view of the rod portion of a pop rivet according to a second embodiment of the present invention;

FIG. 7 is an end view of the pop rivet of Figure 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

5 The present invention is of a pop rivet which can be installed in a single action which resembles drilling.

The principles and operation of a pop rivet according to the present invention may be better understood with reference to the drawings and the accompanying description.

10 Referring now to the drawings, Figure 2 illustrates one embodiment of a pop rivet according to the present invention.

The pop rivet includes a hollow, preferably cylindrical, outer sleeve 10 which surrounds a portion of an inner rod 12 which fits inside sleeve 10. Inner rod 12 is typically, but not necessarily, longer than sleeve 10 so that one of its ends extends well beyond the posterior end of sleeve 10.

As in conventional pop rivets, sleeve 10 features an enlarged head area 14 at its posterior end which has a diameter which is significantly larger than that of the body of sleeve 10 (see also Figure 4). The anterior ends of sleeve 10 and rod 12 are connected to each other, in any convenient manner, so as to act as a single integral piece.

20

A pop rivet according to the present invention is characterized in that (1) inner rod 12 includes means for rotating inner rod 12; (2) the anterior end of inner rod 12 includes or is connected to (hereinafter "includes") a drilling head 18; and (3) at least a portion of inner rod 12 is 5 externally reverse threaded while at least a portion of sleeve 10 is internally reverse threaded so as to engage the externally reverse threaded inner rod. These features are described in more detail below.

Inner rod 12, which is preferably substantially cylindrical, is preferably made from a relative strong metal, for example from the same 10 types of metals presently used for making nails and screws. Sleeve 10, which is preferably substantially cylindrical, may be made of any convenient material including the various materials used in conventional pop rivets, for example, from aluminum.

The anterior end of inner rod 12 is connected to, or is preferably 15 formed with, (both options being referred to hereinafter as "includes") a drilling head 18 which may resemble the anterior end of a typical screw. Preferably, drilling head 18 resembles the drilling head of a typical drill bit. The outer diameter of drilling head 18 is roughly equal to, or slightly larger than, the outer diameter of the body of sleeve 10. Preferably, the 20 drilling portion of drilling head 18 is somewhat separated from sleeve 10 so as to avoid damage to sleeve 10 when inner rod 12 is withdrawn, as described below.

At least a portion of inner rod 12 and at least a portion of sleeve 10 are threaded in complementary fashion. The threading is reversed in the sense that the direction of the thread is opposite to that conventionally used to insert a screw into a substrate. Thus, if the convention is, as is
5 commonly the case in most of the world, that a clockwise rotation of a screw leads to its insertion into a substrate, then the threading of inner rod 12 and sleeve 10 is counterclockwise, so that clockwise rotation of inner rod 12 leads to its withdrawal from sleeve 10. Therefore, it is essential for a pop rivet according to the present invention that the directionality of
10 the threads of inner rod 12 and sleeve 10 be opposite to the directionality of drilling head 18.

Finally, as is described below, inner rod 12 of a pop rivet according to the present invention needs to be rotatable. Hence, means must be provided for rotating inner rod 12. Various such means may be
15 envisioned, including, for example, the grasping of the inner rod 12 by a suitable device which then rotates inner rod 12. The term "means for facilitating rotation" as used in the claims is intended to expressly include the situation wherein no special physical features of inner rod 12 are present and the rotation is achieved through the grasping of inner rod 12
20 by some external mechanism.

Preferably inner rod 12 is provided with features which facilitate the rotation inner rod 12. Two such features are illustrated in Figures 2 and 3 and in Figures 6 and 7.

In Figures 2 and 3, inner rod 12 is equipped near its posterior end 5 with one or more (two are shown in Figures 2 and 3) radially extending protrusions 20. Protrusions 20 are designed to fit slidably into the slits 30 a special rotating tool 32 (Figure 5). The posterior end of rotating tool 30 fits into a conventional drill (not shown) so that rotating tool 30 is used in the same way as a drill bit. Thus, rotation of rotating tool 30 serves to 10 rotate inner rod 12.

In Figures 6 and 7, the posterior end of inner rod 12 includes a section which has a polygonal cross section 26 (hexagonal in Figure 7). A rotating tool (not shown) similar to that shown in Figure 5 may be used but without slits 30 and with the addition of a complementary polygonal 15 recess at the posterior end of the cavity of the rotating tool. When the posterior end of inner rod 12 is engaged in the polygonal recess of the rotation tool, rotation of the rotating tool serves to rotate inner rod 12.

The portion of the body of sleeve 14 of a pop rivet according to the present invention which is near enlarged head 14, is preferably enlarged 20 to form an enlarged section 34 which features a diameter which increases progressively in the direction away from drilling head 18 to a diameter which is larger than that of drilling head 18. Preferably, enlarged section

34 is externally threaded, as shown in Figure 2. The function of enlarged section 34 is to more firmly immobilize sleeve 10 as is described below. Alternatively, the anterior surface of enlarged head 14 could be a friction surface which will also serve to immobilize sleeve 10.

5 To install a pop rivet according to the present invention it is not necessary to use a special pneumatically driven rivet tool. Instead, all that is necessary is a drill (which is needed in any case in installing a conventional pop rivet) and a special 'drill bit' in the form of a suitable rotating tool.

10 Unlike the installation of a conventional pop rivet which requires drilling a hole with a drill and then installing the rivet with a rivet device, a pop rivet according to the present invention is installed in a single action using a single tool.

To install a pop rivet according to the present invention the pop
15 rivet is inserted into a rotating tool connected to a conventional drill. The anterior end of the pop rivet, i.e., drilling head 18, is placed at the spot where the rivet is to be installed. The drill is activated which causes drilling head 18 to drill a hole through the objects to be connected. Since inner rod 12 and sleeve 10 are connected, rotation of inner rod 12 also
20 rotates sleeve 10 so that they rotate together as a single body. Once drilling head 18 has drilled completely through the objects to be connected, the entire pop rivet moves more quickly anteriorly and the

external threads of enlarged section 34 (or other means, such as, for example, the anterior friction surface of enlarged head 14) causes sleeve 10 to engage the first of the objects to be connected so as to immobilize sleeve 10.

5 At this point sleeve 10 is immobilized and can no longer rotate. Since the drill continues to rotate inner rod 12, inner rod 12 now begins to rotate relative to sleeve 10, which is immobilized. However, since inner rod 12 and sleeve 10 are reverse threaded, the rotation of inner rod 12 leads to its posteriorly-directed movement, i.e., inner rod 12 moves out
10 away from the object to be connected. This movement leads, as in conventional pop rivets, to the deformation of the anterior end of sleeve 10 so that the effective diameter of the anterior end of sleeve 10 becomes larger than that of the hole through the object to be connected. Continued rotation of inner rod 12 places the enlarged portion of sleeve 10 up against
15 the back surface of the far object to be connected so that no further motion of sleeve 10 is possible. At this point, continued rotation of inner rod 12 causes inner rod 12 to break off near its anterior end, preferably at a deliberately weakened point, leaving sleeve 10 permanently in place to firmly connect the objects. The broken off inner rod 12 is simply
20 discarded.

While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications and other applications of the invention may be made.

WHAT IS CLAIMED IS:

1. A pop rivet, for connecting two or more bodies together, comprising:
 - (a) an inner rod having a drilling head of an effective diameter at its anterior end, at least a portion of said inner rod being externally reverse threaded, said inner rod including means for facilitating rotation of said inner rod; and
 - (b) a sleeve surrounding at least a portion of said inner rod, said sleeve having a body and an enlarged head at its posterior end, at least a portion of said sleeve being internally reverse threaded so as to engage said externally reverse threaded inner rod.
2. The pop rivet of claim 1, wherein said sleeve is substantially cylindrical.
3. The pop rivet of claim 1, wherein said inner rod is substantially cylindrical.

4. The pop rivet of claim 1, wherein a portion of said body of said sleeve near said enlarged head has a diameter which increases beyond said effective diameter of said inner rod drilling head toward said head.
5. The pop rivet of claim 4, wherein said portion is externally threaded.
6. The pop rivet of claim 1, wherein said enlarged head of said sleeve includes a friction surface.
7. The pop rivet of claim 1, wherein said inner rod includes at least one radial protrusion for facilitating the rotation of said inner rod.
8. The pop rivet of claim 1, wherein said inner rod includes a polygonal section at its posterior end for facilitating the rotation of said inner rod.

FIG. 1
PRIOR ART

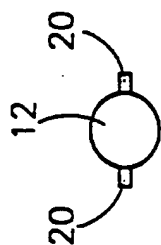
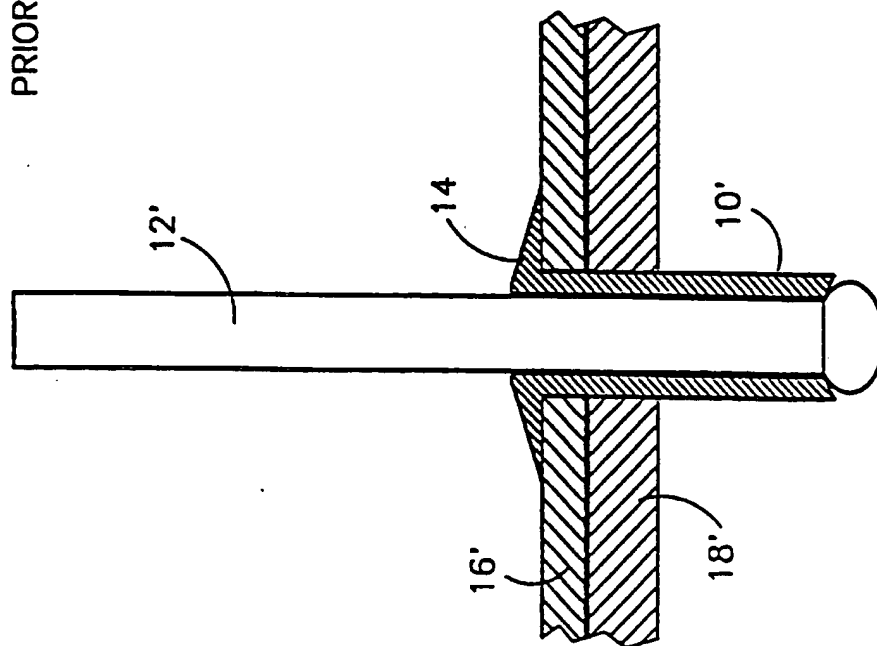


FIG. 3

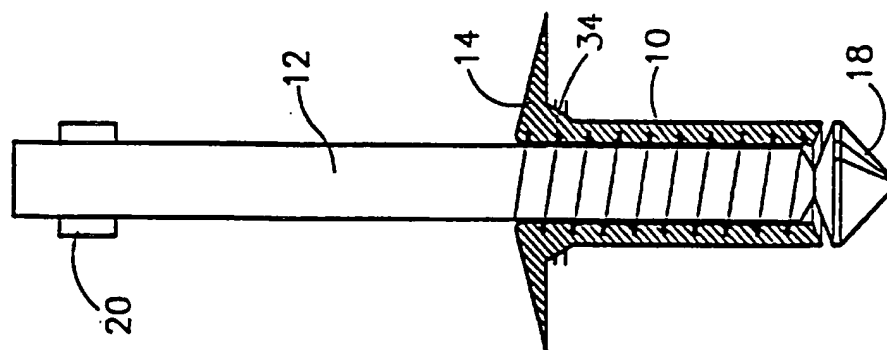


FIG. 2

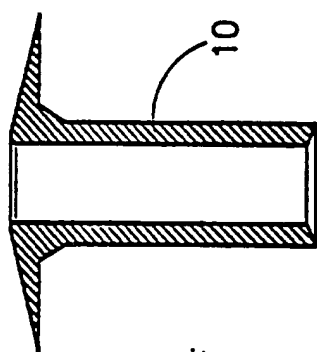


FIG. 4



FIG. 5A



FIG. 5B

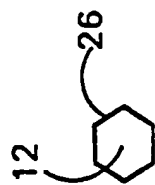


FIG. 7

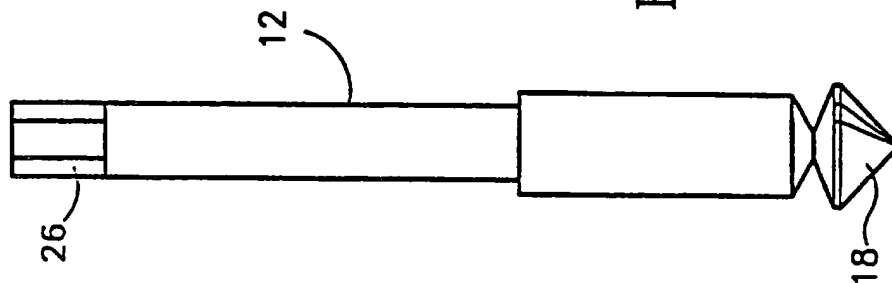


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/01777

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : F16B 13/04, 13/06

US CL : 411/29, 43, 55

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 411/29-31, 43, 55

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A, 3,403,593 (MOORE) 01 OCTOBER 1968 (see entire document)	1-8
X	US,A, 3,453,927 (MOORE) 08 JULY 1969 (see entire document)	1-8
X	US,A, 5,183,357 (PALM) 02 FEBRUARY 1993 (see entire document)	1-8
X	US,A, 5,213,459 (PALM) 25 MAY 1993 (see entire document)	1-8

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search

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